ROTUNDA

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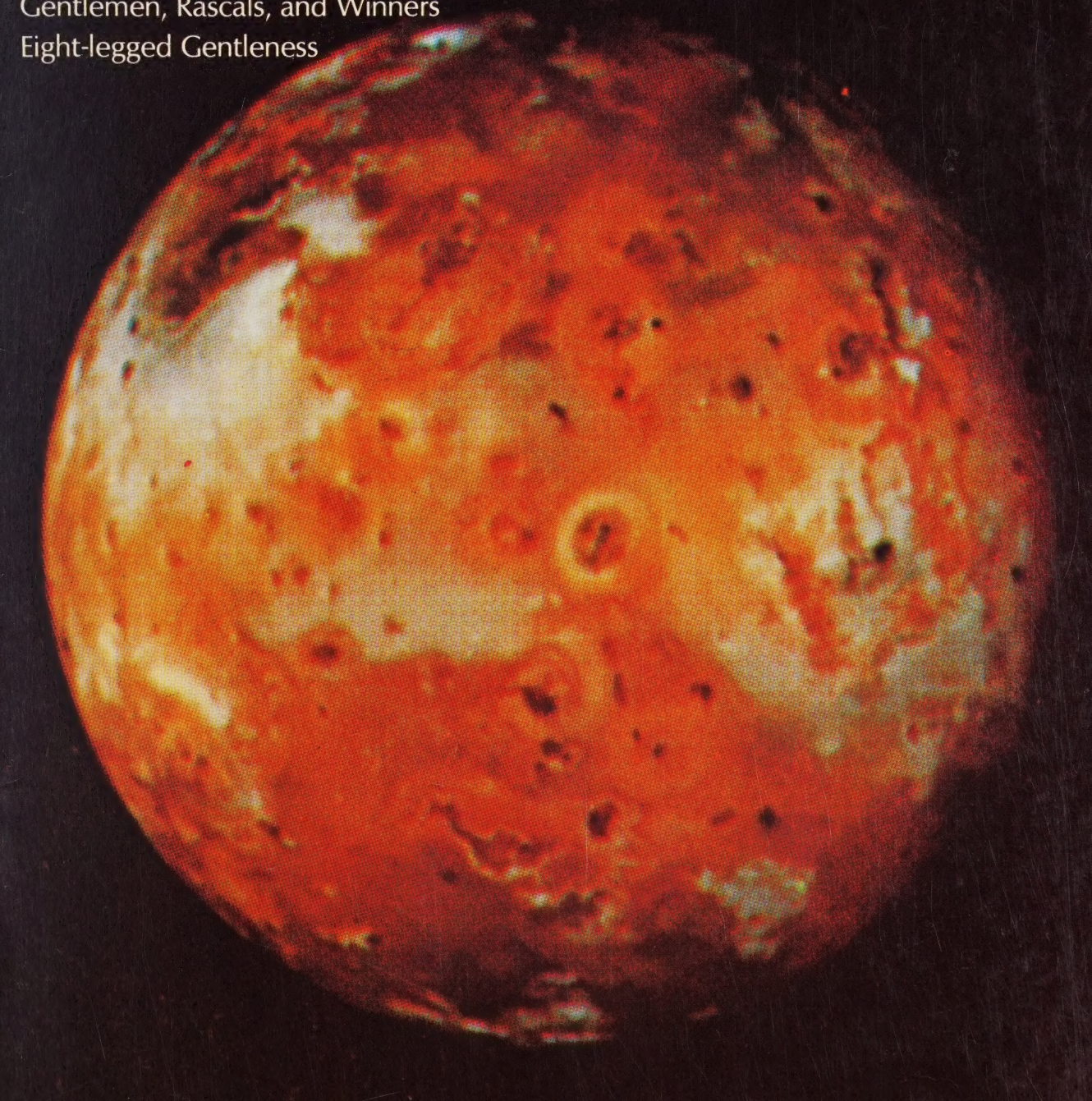
"A Watry Pilgrimage" of 1578

To Other Worlds

Gentlemen, Rascals, and Winners

Eight-legged Gentleness



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Cover: Io, one of Jupiter's largest moons, resembles a giant "pizza in the sky". The orange red colour of its surface is the result of extensive volcanic activity. (Photo: NASA)

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On Early Printmaking in Canada

Mary Allodi

Adam Mabane, Esqr. *This expressive profile is one of the earliest portraits to be engraved, printed, and published in Canada. It was engraved by J.G. Hochstetter and illustrated the obituary of Judge Mabane (a prominent local citizen) in the* Quebec Magazine *in 1793. (Collection: Library of Parliament, Ottawa)*

FOR THE FIRST TIME, an exhibition and accompanying catalogue will illustrate and describe the development of pictorial printing in Canada from the 1790s until 1850. The exhibition, *Printmaking in Canada: The Earliest Views and Portraits,* will be mounted at the Canadiana Building of the Royal Ontario Museum from 18 April to 25 May, at the McCord Museum, Montreal, from 11 June to 13 July, and at the Public Archives of Canada, Ottawa, from 25 July to 1 September 1980.

The 121 engravings and lithographs in the exhibition come from eighteen different collections. Many of the prints have never been exhibited before, and some are known to exist in only one or two surviving impresssions. The rarity of the early prints produced in Canada can be attributed to several factors. Some subjects may have been printed in limited numbers. Early prints were often modest in both size and execution and consequently were overlooked by later generations. Subjects printed on paper of poor quality have not endured. The 19th-century custom of varnishing prints led to the deterioration of many fine examples. The prints that have been preserved were often found tucked away in albums and portfolios, or among stored family papers, where they were not exposed to the damaging effects of light.

The best-known prints of Canadian subjects are those that were drawn or painted in Canada but were engraved or lithographed abroad—in England, France, Germany or the United States. For example, W.H. Bartlett's Canadian scenes were engraved in England, Thomas Young's Toronto views were lithographed by Nathaniel Currier in New York, and the paintings of the famed Cornelius Krieghoff were reproduced as lithographs in Germany and the United States. Those names and their prints are familiar to most collectors of Canadiana, whereas the artists and printmakers who collaborated to paint, print, and publish views in Canada are long forgotten.

Both the exhibition and the catalogue are the result of a research project into the printing of the earliest views and portraits in Canada. The study focused on separately issued prints, which were intended to stand on their own merits as pictures, rather than on book illustrations, which were combined with text to tell a story. However, some of the earliest engravings and lithographs which appeared in small periodicals are included in the exhibition as examples of the first views issued. These prints bring to light the names of artists and printers, publishers and patrons, who worked together to introduce the printmaking art to Canada. Many pioneers in this field will be introduced in the exhibition. Men such as J.G. Hochstetter of Quebec, John Gillespie of Toronto, Adolphus Bourne of

Left: Quebec Driving Club. *Among the most delightful examples of early lithography in Canada is this sleighing scene showing Captain Doyle driving Lord Aylmer's four-in-hand. In the early 1830s members of this club used these lithographs as letter paper, invitations, and menus. Examples of the same kind of scene, printed on coloured papers, occasionally turn up in old scrapbooks. (Collection: Canadiana Department, Royal Ontario Museum)*

Above: St. George's Society Membership Certificate. *The copper plate for this membership certificate was engraved by Charles W. Torbett of Halifax in about 1819. Against a background view of Halifax harbour, the artist has depicted a mourning figure beside the tomb of John Howard, an 18th-century British philanthropist. (Collection: Nova Scotia Museum, Halifax)*

Left: London Fashions. *This naively drawn lithograph is possibly the first fashion plate to be printed in Canada. It shows the latest London styles for morning and evening dress and appeared in the March 1831 issue of the* Montreal Monthly Magazine, *the first Canadian-printed periodical to use lithographic illustrations. (Collection: Bibliothèque de la Ville de Montréal, Collection Gagnon)*

VUE DU MONUMENT NATIONAL ET RELIGIEUX ÉRIGÉ SUR LA MONTAGNE DE St HILAIRE DE ROUVILLE, CANADA
ET BÉNI PAR MG^r DE FORBIN-JANSON, ÉVÊQUE DE NANCY, &c &c
le 6 Octobre 1841.

Above: View of the Religious Monument at St. Hilaire de Rouville seen from the Lake on the Mountain. *This lithograph was commissioned by the Curé of Beloeil as an edifying souvenir of the inauguration of a religious monument in October 1841. At the left the Bishop of Nancy can be seen preaching to a waterfront throng from a raft just offshore. The pleasing landscape was drawn on stone by artist John Penniman and was printed by Adolphus Bourne of Montreal. (Collection: McCord Museum, Montreal)*

Right: The Admiralty House, Kingston. *This view of the Admiralty House on the grounds of the Royal Military College is dominated by a portrait of the wooden warship H.M.S.* Cherokee, *built at Kingston in 1841–42. The image was drawn on stone by John Gillespie and lithographed by the Toronto firm of Scobie & Balfour, c. 1848–50. (Collection: Metropolitan Toronto Library)*

Opposite page: The Countess of Elgin and Lady Alice Lambton Receiving Bouquets at Upper Canada College, Toronto. *The visit of the governor general to Upper Canada College in 1847 is commemorated in this rare interior view and group portrait. A solemn company of professors and officials watch two schoolboys present flowers to the countess and her sister. The composition was drawn by Thomas H. Stevenson, landscape and portrait painter, and was printed by John Ellis of Toronto. (Collection: Metropolitan Toronto Library)*

THIS LITHOGRAPHIC ENGRAVING OF
The COUNTESS of ELGIN & LADY ALICE LAMBTON,
His Excellency LORD ELGIN & KINCARDINE, Governor General &c. &c.

Montreal, and Charles Torbett of Halifax are among these unsung heroes.

The prints fall naturally into geographic areas, both in regard to subject and to place of execution. Quebec City was the first centre of activity, as early as 1792. The period from 1816 through the 1820s was one of creative printmaking in Halifax. By 1830 Montreal printers dominated the field. The most recently settled of the areas studied, Upper Canada (Ontario), did not produce its own prints until the 1830s, and only two examples of printing in New Brunswick have been located. The date 1850 was chosen as the end of the early era studied because soon after that the advent of wood-engraved news illustrations and the development of chromolithography produced a deluge of pictorial material.

The subjects of the prints were of popular interest in their day, and each view or portrait combines art with history. The earliest prints often depicted newsworthy items and were published to inform the public of an important event, such as the execution of Louis XVI. The city view, the most popular subject of all, was sometimes printed to celebrate the completion of a fine new building. Churches, benevolent societies, and private clubs commissioned prints which document their activities. Public works such as new bridges and canals were among the early pictorial themes, and portraits of the good or the famous found a ready market. Reading the early newspapers has, in many instances, provided the background story to the publication of these printed pictures.

The bilingual catalogue, in English and French, is intended not only as a guide to the exhibition, but also as a reference work on the subject of early printmaking in Canada. Each entry comprises an illustration accompanied by a descriptive commentary which includes the technical and social history of the print, biographical notes on artists and printers, and locations of existing impressions. The introduction summarizes the results of all research to date.

We hope that much new information will come to light in response to this first publication on early Canadian printmaking. Already, as a result of the wholehearted cooperation of those who lent prints to the exhibition and of participating institutions, many puzzles have been solved and new discoveries have been made. As is the case with any first work, there are still questions to be answered and unknown prints to be located.

Mary Allodi is Assistant Curator, Canadiana Department.

Polar bear, Frobisher Bay.

The Reverend Robert Wolfall in Arctic Canada

"A Watry Pilgrimage" of 1578

Walter A. Kenyon

ON MONDAY 21 JULY 1578, two small English ships, the *Judith* and the *Michael* dropped their anchors just off Newland Island in the Countess of Warwick Sound on Baffin Island. Martin Frobisher had discovered the sound the previous year, and had named it after Anne Russell, the wife of his patron, the Earl of Warwick. It was given this regal honour because Frobisher had discovered vast quantities of glistening rock in the area, and his assayers (or goldfiners as they were called at the time) were convinced that the rocks were generously laced with gold. And so in 1578, with a fleet of fifteen vessels, Frobisher sailed on his third and final voyage to what is now Arctic Canada. The fleet left Harwich on 31 May, sailing in convoy as far as Cape Farewell at the southern tip of Greenland. When the vessels left the cape, however, they were plagued by light, variable winds, with endless fog and rain. As they drifted around Davis Strait, the fleet was scattered, till finally the *Judith* was alone.

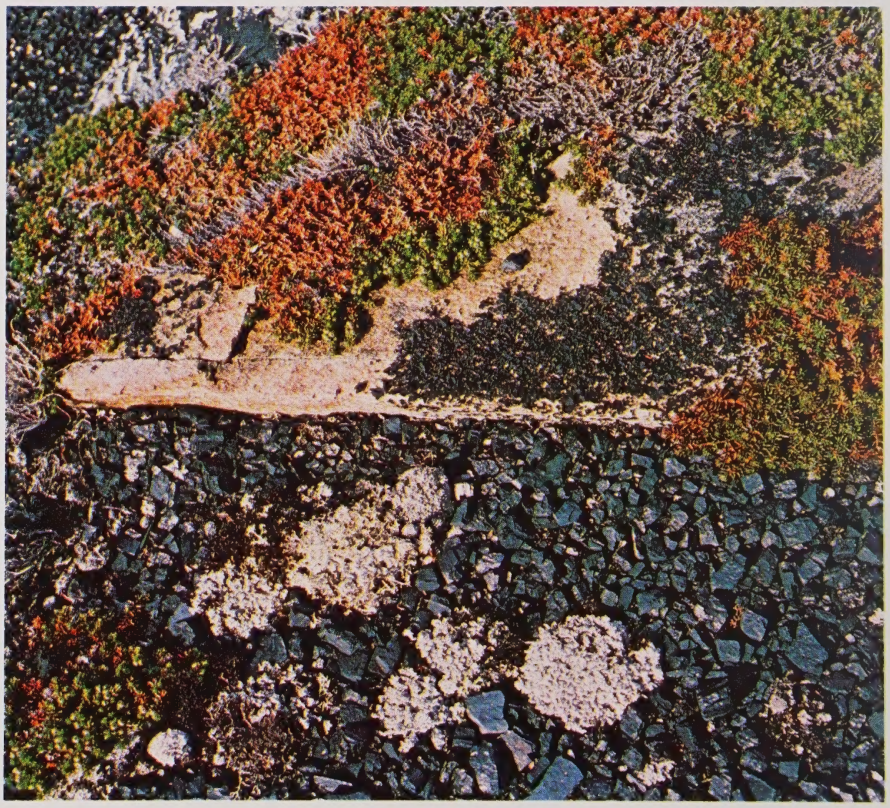
On 13 July, near the entrance to Frobisher Bay, she sighted the *Michael*. The two vessels then stayed together for the next eight days as they continued to battle the persistently hostile elements and to watch anxiously for some sign of the rest of the fleet. But they did not see another sail, and when they finally dropped their anchors in the Countess of Warwick Sound, that broad, safe anchorage was deserted. The fleet was still at sea.

In command of the *Judith*—and lieutenant general of the entire fleet—was Edward Fenton. As soon as his vessels were secure, Fenton tells us, he assembled his men, and they "gave hartie thanks to god for his gracious and mightie deliveraunce from so manie greate and daungerfull perills", and then, as it was about noon, they "wente to dynner". (The Fenton material presented here is taken from Manuscript 1125 in the Pepys Library. It is reproduced by kind permission of the Masters and Fellows, Magdalene College, Cambridge.) The rest of the day was spent in exploring the sound and in watching from a low hill for any sign of the other vessels. Outside the sound, however, in Frobisher Bay itself, there was nothing but ice, solidly packed, and drifting back and forth with the tide.

Above: Sunset, Countess of Warwick Sound.

Right: Deposit of coal left by Frobisher in 1578.

Opposite page: Countess of Warwick Sound.



Fenton's journal entry for the next day, 22 July 1578, reads as follows:

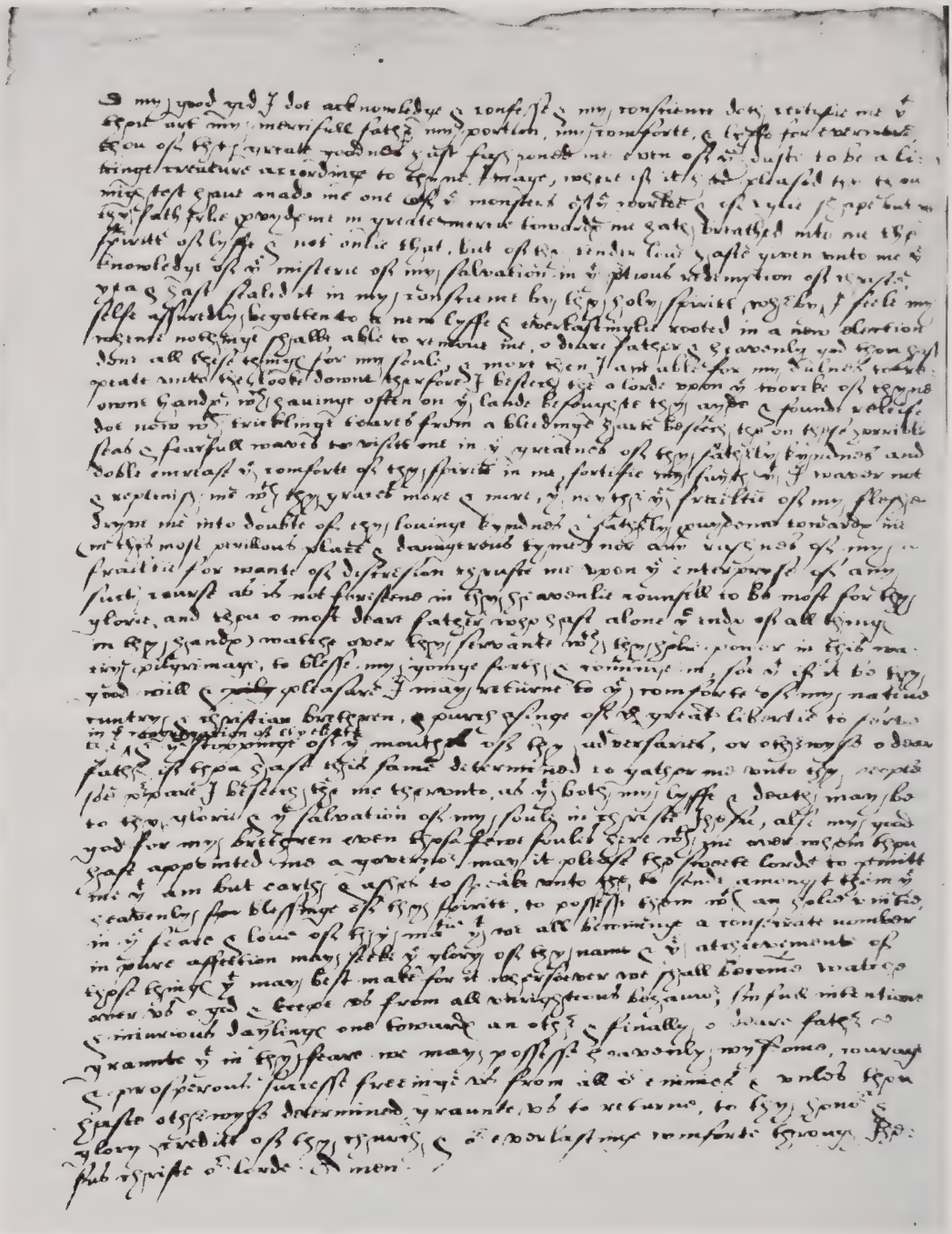
> Tewsdaie the xxiith daie: we did receave the Communion altogether, contynewing that daie in prayer and thanks givinge to god, aswell for the delivering of us from the daungers paste, as also for his greate goodnes in placinge us in so saffe an harbour. Desiering him of his mercie to contynue this his greate good favour towardes us. This daie it blew verie much winde at the northwest.

The service which the officers and men of the *Judith* attended that day is the earliest recorded Anglican Communion Service in Canada. It was celebrated by the Reverend Mr. Robert Wolfall, whom Frobisher had engaged after Queen Elizabeth had instructed him to take "a minister or twoo" on his next voyage to the northwest. Mr. Wolfall, who sailed aboard the *Judith*, was rector of the parish of Christon in Somerset and vicar of West Harptree in the same county. He was about thirty-three years old at the time, married, and the father of several children. (For biographical data on Wolfall, see "Robert Wolfall—The First Anglican Clergyman in Canada", by J.P. Francis, in the *Journal of the Canadian Church Historical Society*, Vol. XI, No. 1, March 1969.)

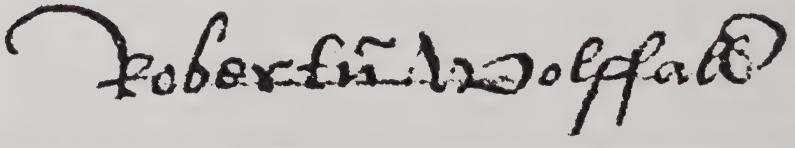
Wolfall is mentioned but once in Captain Fenton's journal, on 27 July while the two vessels were still riding at anchor in the sound, waiting for the appearance of the rest of the fleet. On that day, we are told, "The Master [Mr. Skipwith, master of the *Judith*] and Master Wulfall wente to Winters Furnace", which Fenton described as "an Iland verie apte to ancour by". They went there "to looke for the Generalls cominge but could not see him or any of the Shipps".

Frobisher did not arrive in the sound till 31 July; and the last of his widely scattered ships, the *Ann Frances*, did not appear there till 28 August, just two days before the fleet sailed for England. It was a short, frantic summer for Frobisher and his men. As each vessel appeared, it was laden with "ore" from the various mines, and then prepared for the homeward voyage. Before that hectic month was over, the expedition had mined and loaded 1,350 tons of rock.

After an uneventful return voyage, Fenton and Wolfall landed in Weymouth on 30 September. As soon as they were safely at anchor, they "sett divers men on shoore and others willing to departe to their frindes, the Shipp being pestred with 67 men, the moste parte wherof infected with the skurvie and other daungerfull diseases". Meanwhile, however, the bubble of hope and cupidity which had sustained the Frobisher project for three years finally burst. Even the most sanguine admitted that the "ore" was useless. There simply was no gold!



Wolfall's signature. (Reproduced by kind permission of the Record Office, Taunton, Somerset)



Wolfall returned to his parish in West Harptree where he must have been something of a celebrity among the other clergymen of Somerset. But he settled down to his pastoral duties, and spent the rest of his life quietly tending his flock. He died there in 1610.

In spite of the fact that Wolfall is mentioned only on that single occasion, he left us a vivid sign of his presence. It consists of a prayer, written in a tight, legible script, which occupies the whole of page five of the Fenton manuscript. On internal evidence, the prayer was written by Mr. Wolfall during the voyage, which he described as a "watry pilgrimage". With modern spelling and punctuation, the prayer reads as follows:

> O my good God I do acknowledge and confess (and my conscience doth certify me) that Thou art my merciful Father, my portion, my comfort, and life for evermore. Thou of Thy great goodness hast fashioned me even of the dust to be a living creature according to Thine image, when if it had pleased Thee, Thou mightest have made me out of the monsters of the world and of ugly shape, but that Thy fatherly providence in great mercy towards me hath breathed into me the spirit of life; and not only that, but of Thy tender love hast given unto me the knowledge of the mystery of my salvation in that precious redemption of Christ, yea, and hast sealed it in my conscience by Thy holy spirit, whereby I feel myself assuredly begotten to a new life, and everlastingly rooted in a new election whence nothing shall be able to remove me. O dear Father and heavenly God, Thou hast done all these things for my soul, and more than I am able, for my dullness, to repeat unto Thee. Look down, therefore, I beseech Thee, O Lord, upon the work of Thine own hands, who having often on the land besought Thine aid and found relief, do now with trickling tears from a bleeding heart beseech Thee on these horrible seas and fearful waves to visit me in the greatness of Thy fatherly kindness, and doubly enter also the comfort of Thy spirit in me. Fortify my faith that I waver not, and replenish me with Thy graces more and more, that neither the frailty of my flesh drive me into doubt of Thy loving kindness and fatherly providence towards me (in this most perilous place and dangerous time) nor any rashness of my frailty for want of discretion thrust me upon the enterprise of any such course as is not foreseen in Thy heavenly council to be most for Thy glory. And Thou, O most dear Father, who hast alone the ends of all things in Thy hands, watch over Thy servant with Thy holy power in this watery pilgrimage, to bless my going forth and coming in, so that if it be Thy good will and pleasure I may return to the comfort of my native country and Christian brethren, and purchasing of the great liberty to serve in the congregation of Thine elect, and the stopping of the mouths of Thine adversaries. Or otherwise, O dear Father, if Thou hast this same determination to gather me unto Thy people, so prepare, I beseech Thee, me there unto, as that both my life and death may be to Thy glory, and the salvation of my soul in Jesus Christ. Also my good God, for my brethren—even those few souls here with me over whom Thou hast appointed me a governor—may it please Thee sweet Lord to permit me that am but earth and ashes to speak unto Thee, to send amongst them the heavenly blessing of Thy spirit, to possess them with an holy virtue in the fear and love of Thy majesty, that we all, becoming a consecrate number in pure affection, may seek the glory of Thy name, and the achievements of those things that may best make for it wheresoever we shall become. Watch over us, O God, and keep us from all unrighteous behaviour, sinful intentions, and injurious dealings, one towards another. And finally, O dear Father, grant that in Thy fear we may possess heavenly wisdom, courage, and prosperous success, freeing us from all our enemies. And unless Thou hast otherwise determined, grant us to return, to Thine honour and glory, credit of Thy church and our everlasting comfort through Jesus Christ our Lord. Amen

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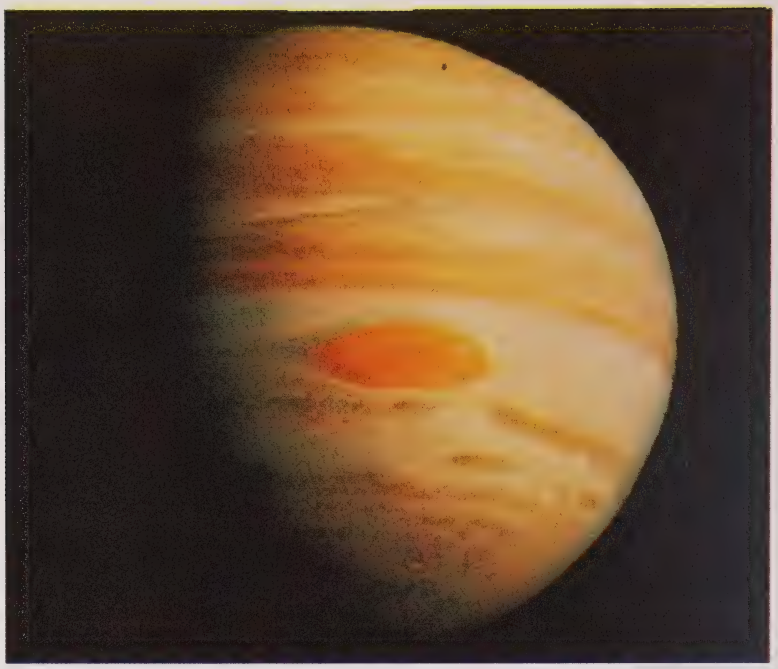
Walter A. Kenyon, with the Royal Ontario Museum since 1956, is a Curator in the Department of New World Archaeology. Most of his work has been devoted to the prehistory and early history of Ontario, and the underwater archaeology of the old canoe route of the fur traders. He is the author of three books on northern exploration: The Battle for James Bay *(with J.R. Turnbull),* The Strange and Dangerous Voyage of Capt. Thomas James, *and* Tokens of Possession: The Northern Voyages of Martin Frobisher.

To Other Worlds



The Age of Planetary Exploration

Ian G. McGregor

WITHIN THE PAST TWO DECADES our understanding of our place in the universe has undergone a tremendous revolution. It began with the first hesitant and not always successful steps into space by robot spacecraft. Now astronauts have walked on the surface of the Moon and unmanned craft have visited most of the nearby planets.

As a consequence of this revolution, our perceptions of these other worlds have changed dramatically. On our TV screens we have seen astronauts gather rocks on the barren surface of the Moon, our nearest neighbour in space, and have witnessed Earth rise from it. The camera eyes of the Mariner 10 spacecraft have revealed Mercury to be a world closely resembling the Moon. Venus, the brilliant Morning and Evening Star named after a goddess of love and beauty, has been revealed as an unearthly hell rather than a celestial paradise. The few spacecraft that have attempted the perilous descent to Venus's hidden surface and have experienced its extreme heat and its other climatic conditions measured their endurance in minutes. And Mars, the red planet, source of more mystery and expectations than any of the other major planets, has shown itself to be both earthlike and moonlike in its features, with its mighty volcanoes, vast valleys, cratered surface, and polar caps of ice. But is there life on the planet? The question remains unanswered.

Since 1961 there have been forty-four missions to the Moon, and thirty-three unmanned probes have studied the planets. Because of the information sent back, we will never again view the planets as just distant points of light in the night sky but will now see them as worlds in their own right, each with its own individual characteristics. Haunt-

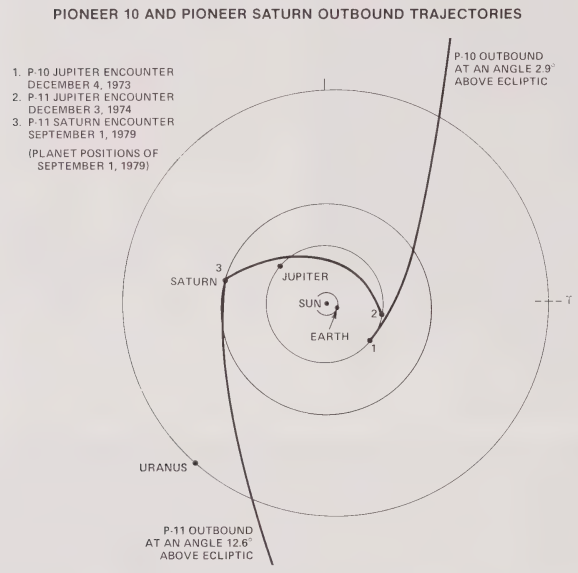
Opposite page: A Pioneer 11 view of Jupiter and its Great Red Spot in December 1974.

Left: Voyager 1 photograph of Jupiter and its satellites Io (left) and Europa. The spacecraft was about 20 million kilometres from the giant planet when the photograph was taken. Behind and below Io is Jupiter's Great Red Spot.

Below: Jupiter's Great Red Spot was first observed more than 300 years ago. More than three times the size of Earth, the Spot is an immense storm whose origin is a mystery.

Bottom: The solar system consists of the Sun and its family of nine planets. It is possible that by the late 1980s seven of the planets will have been studied by unmanned spacecraft.

Below: Diagram of outbound trajectories of Pioneer 10 and Pioneer 11.

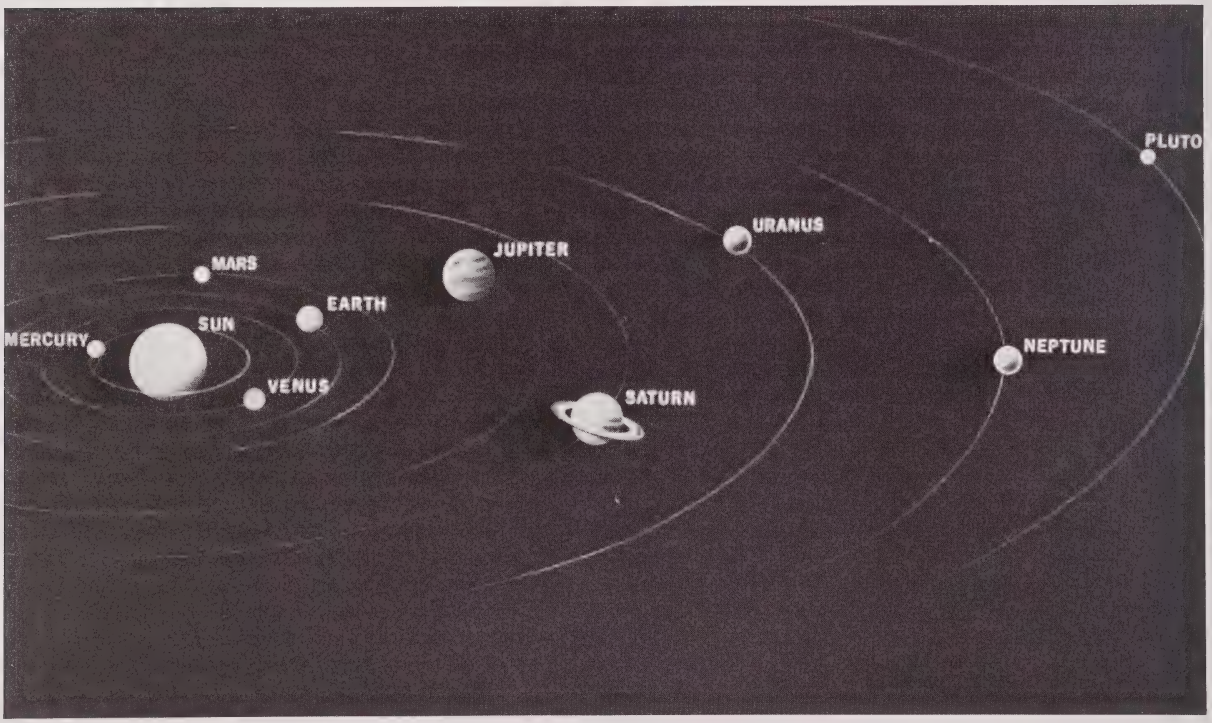


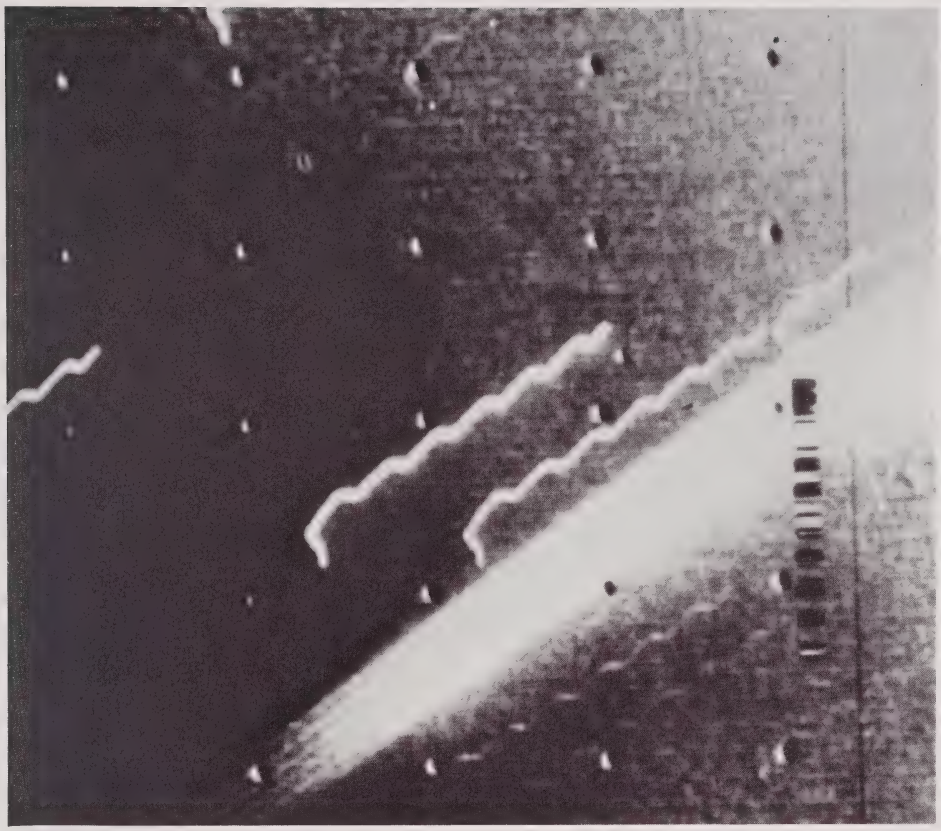
ingly beautiful planetscapes of other worlds, observed by robot eyes millions of kilometres away from Earth, have captured our imaginations.

We live in the midst of one of the great periods of human discovery, when from our small planet, third in distance from the Sun, mankind is reaching out into the universe. For many astronomers, scientists, and space enthusiasts, the last twenty years have been the "golden age of space exploration", a period during which human beings began the close-up study of their celestial neighbours and gained a greater appreciation of their own world.

In many ways the epic voyages of spacecraft across the vast empty oceans of space recall a time hundreds of years ago when explorers sailed from Europe to discover new lands and people on our own planet. Just as we associate the names of Magellan, Columbus, and Cook with those earlier days of exploration, so we now identify spacecraft—Mariners, Pioneers, and Voyagers—as the explorers of our own age.

Until 370 years ago the planets were recognized just as bright stars, wandering slowly against the background of the fixed stars. Then in the winter of 1609/10 the Italian scientist Galileo Galilei turned a primitive telescope towards the heavens. One of his first observations was that the planet Jupiter was accompanied by four satellites or moons of its own, and thus resembled a miniature solar system. The announcement of his discovery in *Sidereus Nuncius* (Starry Message) in March 1610 led to the first of Galileo's well-known conflicts with the Catholic Church.





A multiple exposure of Jupiter's faint ring can be seen as a broad light band crossing the centre of the picture. Background stars appear as wavy star trails, and black dots are instrument calibration points.

Today we know of more than thirty-five moons orbiting the planets, with as many as four discovered just in the past two years!

Although the nine known planets all have their own individual characteristics, it is possible to classify them into three groups. The terrestrial or "Earth-like" planets are four in number: Mercury, Venus, Mars, and, of course, Earth itself. These planets are small, rocky worlds huddled close to the central Sun and have either very thin atmospheres of gas or no atmosphere at all. As the Moon is only slightly smaller than Mercury, it is often included with the terrestrial planets.

Until recently the tiny world of Pluto was also grouped with the terrestrials. Now, however, it is thought to be more like a big ball of ice and snow than a rock world, and so it stands alone as an ice planet.

Finally there are the gas giants: Jupiter, Saturn, Uranus, and Neptune. These worlds are composed principally of gas and are tens of times larger than the planets of the terrestrial group. Jupiter, the largest of the gas giants, has more than 300 times the mass and ten times the diameter of Earth, and more than a thousand Earths could fit inside it, with space left over. Despite its enormous mass and huge size, Jupiter consists mostly of hydrogen and helium, the lightest of the known chemical elements.

Worlds of rock, worlds of ice, and worlds of gas, giant worlds and tiny worlds—these are the members of the Sun's family. All of the nine planets orbit around the Sun, with orbital periods ranging from 88 days for sun-scorched Mercury to 248 years for frozen Pluto. And orbiting the planets, especially the gas giants, are more than thirty-five moons, some larger than Mercury, others no larger than the city of Toronto.

By far the most important object in the solar system is the Sun, our nearest star. A gigantic ball of hot, turbulent gas, the Sun comprises 99.87 per cent of the total mass of the solar system. Everything else—the planets, their moons, the thousands of asteroids, perhaps millions of comets, and other bits of rock and dust, sometimes of microscopic dimensions—accounts for only a fraction of the system's total mass. It is as if the solar system consisted of only one star—with everything else in the system representing the leftovers, or garbage if you like, from that star's formation.

Before the telescope was first used to observe the sky by Galileo in 1610, only five planets besides Earth were known. Visible to the unaided eye and often appearing as the brightest "stars" in the sky, Mercury, Venus, Mars, Jupiter, and Saturn had been observed for thousands of years, although in the prescientific age they were not recognized as planets in the same

Opposite page: The disc of Jupiter as seen by Voyager 1. The dark and light features are cloud bands running parallel to the planet's equator and several small white spots resemble the Great Red Spot.

Left: A volcanic eruption on Io can be seen silhouetted against dark space. The Voyagers identified eight active volcanoes on the moon's surface.

way that Earth is a planet.

Many years passed before the next major planet was discovered by William Herschel in 1781. This was Uranus, another giant gas planet resembling Jupiter and orbiting twenty times farther away from the Sun than Earth. Then in 1846 Neptune was discovered by the French astronomer Leverrier and the English astronomer John Adams, both working independently. At that time observations of Neptune suggested that there might be another massive planet, a planet "X", beyond Neptune. A search for this ninth planet began, but it was not until 1930 that it was found by the American astronomer Clyde Tombaugh after an exhaustive study of tens of thousands of stars. Pluto, as the planet was named, turned out to be a disappointment. Not only is it much less massive than scientists had thought it would be (in 1978 it was determined that Pluto is smaller than Earth's Moon), but it has an unusual orbit. At times it is closer to the Sun than Neptune is, as it will be from 21 January 1979 to 16 March 1999. Many scientists believe that Pluto is an escaped satellite of Neptune and not a true planet.

Since the discovery of Pluto our knowledge of the fundamental structure of the solar system has remained essentially unchanged. With the major planets identified, efforts are now concentrated on determining the features of the individual worlds.

Most of the space probes sent to the planets have investigated the worlds nearest to Earth. Mercury has been studied by one spacecraft, Venus by fifteen, both American and Russian, and Mars by fourteen. Within the past year both Jupiter and Saturn have been visited by spacecraft, and the results have been spectacular.

In March and July of 1979 a pair of identical spacecraft named Voyager 1 and Voyager 2 made a flyby of Jupiter, and at the end of August 1979 a single spacecraft named Pioneer 11 made the first reconnaissance of Saturn. But these were not the first craft to visit the outer worlds.

In the late 1960s, with the first manned landing on the Moon imminent, space scientists began to turn their attention deeper into space, towards the giant planets in the solar system. Jupiter, the closest of these planets, was chosen as the target for a two-spacecraft mission which had the threefold purpose of investigating the interplanetary medium, studying the asteroid belt between Mars and Jupiter, and making the first preliminary measurements of the space environment near Jupiter itself. The third objective was critical to the future exploration of the outer planets, because missions were planned that would use Jupiter's gravitational field for a "gravitational boost" to the outer planets. Should Jupiter's magnetic field and radiation belt prove to be too powerful for the spacecraft, exploration of the outer worlds would have to proceed at a much slower pace.

Pioneer 10 and Pioneer 11, as the spacecraft were called, were launched from Cape Kennedy in March 1972 and April 1973 and arrived in the vicinity of Jupiter in December 1973 and December 1974. During their outward journeys both spacecraft sampled the interplanetary environment and the asteroid belt; they found both regions of space to be remarkably free of meteoroid material and dust particles which might endanger a spacecraft. As each made a flyby of Jupiter, approaching as close as 46,000 kilometres to the

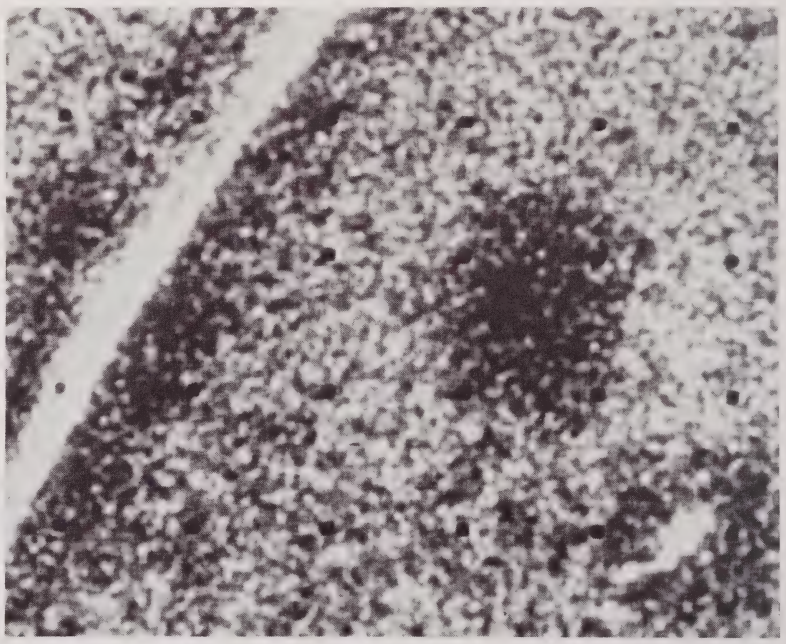
planet's cloudtops, its instruments and cameras gathered a wealth of information which, in a matter of a few days, dramatically increased our knowledge of this giant world.

The Pioneer spacecraft gave scientists the first close-up look at the largest planet in the solar system and supported the theory that it was a spinning ball of liquid hydrogen with no detectable solid surface. As revealed by the space cameras, the brightly coloured markings on the face of Jupiter, which represent clouds stretched into long bands by Jupiter's rapid rotation, showed many minute details. The Great Red Spot, a gigantic storm almost 40,000 kilometres long, was examined and found to be a mass of swirling clouds towering some eight kilometres above the surrounding cloud deck. Jupiter's atmosphere proved to be much more active and turbulent, and its interior much hotter, than expected. Also, Jupiter's magnetic field and radiation belts were found to be much more extensive and more powerful than scientists had thought. The magnetic field is ten times the strength of Earth's field and extends out almost 10 million kilometres from the planet. It is the radiation belts, regions of trapped high-energy particles, that present the main danger to spacecraft. Their total radiation is about 100 times the lethal dose for humans, and the two Pioneer spacecraft barely survived the radiation they experienced. However, the Pioneer missions showed that spacecraft not only could visit Jupiter and complete their missions but also could use Jupiter's mighty gravitational field as a slingshot to the outer planets. Following its flyby, Pioneer 10 continued its outward journey from the Sun, and it will eventually leave the solar system. Pioneer 11 took advantage of the slingshot effect and was sent on a journey, lasting almost five years, to its next target, Saturn.

Though the Pioneer vehicles were relatively advanced spacecraft at the time they were designed in the early 1970s, the next mission to the outer planets was much more elaborate. Called the Voyager program, the mission was to consist of two identical spacecraft, Voyager 1 and Voyager 2, which would visit Jupiter, then be boosted to Saturn, and then, if still functioning years after their initial launch, continue possibly to Uranus, and perhaps even to Neptune.

The Voyagers are much more advanced and sophisticated spacecraft than the older Pioneers. While the Pioneers weighed 270 kilograms, including 33 kilograms of scientific payload, the larger Voyagers weigh 792 kilograms and have an instrument payload of 105 kilograms. Particularly conspicuous is the Voyager's very large 3.7-metre parabolic antenna for communication with Earth. The Voyagers' camera systems, with a resolving power fifty times greater than that of the Pioneers' cameras, produced pictures that were much more detailed than anything possible with Earth-based equipment.

The Voyager mission was planned to take advantage of a rare alignment of the outer planets which finds Jupiter and Saturn both located in roughly the same



Right: A Voyager photograph of the dark side of Jupiter shows a 60,000-kilometre-long aurora along the limb of the planet. The bright spots below the limb are either auroras or gigantic lightning bolts.

Opposite page, left: Ganymede, Jupiter's largest moon, has an interesting pattern of stripes of roughly uniform width crossing its surface. These sinuous ridges and grooves are probably the result of deformation of the moon's thick crust of ice.

Opposite page, right: This photograph of Io, Jupiter's innermost moon, was taken by Voyager 1 at a distance of 30,000 kilometres. The picture shows a crater of irregular shape about fifty kilometres in diameter, with lava flows extending out from it.

part of the sky when seen from Earth. During the period from 1978 to 1981, both planets appear to be moving through the constellation of Leo and the adjacent constellation of Virgo. Originally the American government's National Aeronautics and Space Administration (NASA) had planned a "Grand Tour" of the solar system to include the planets Jupiter, Saturn, Uranus, and Neptune. However, budget cuts eliminated this ambitious and imaginative plan and replaced it with the present Voyager missions, whose primary targets are Jupiter and Saturn.

The Voyagers were to journey first to Jupiter, and to study the planet itself, its family of moons, and its space environment. Then they were to be boosted on to the planet Saturn, to investigate the properties of its strange and beautiful ring system and to examine its largest satellite, Titan.

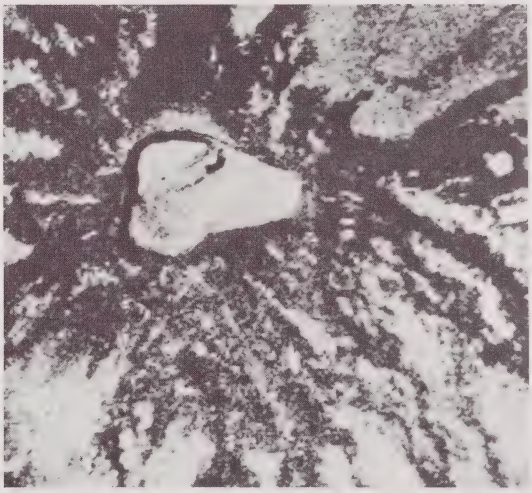
Voyager 1 was launched from Earth on 5 September 1977 for a rendezvous with Jupiter eighteen months later. On 5 March 1979 it reached Jupiter, hurtling past the giant world at a speed of 130,000 kilometres per hour and at a distance above the planet's cloudtops of 280,000 kilometres, or about two-thirds of the distance from Earth to the Moon. Voyager 2 reached Jupiter four months later on 9 July.

The results from the Voyager missions were startling, and they dazzled scientists with sights and discoveries beyond anyone's expectations. Within a few months scientists not only dramatically increased their knowledge of the solar system's largest planet but also were able to study four new worlds—the four moons of Jupiter first observed by Galileo in 1610.

The Voyager spacecraft transmitted more than 30,000 photographs back to Earth, and major discoveries were made. Jupiter's atmosphere was found to be far more turbulent than anyone had supposed. The Voyager cameras revealed a wealth of detail and structure, with noticeable changes taking place even within the four-month period between the visits of the twin spacecraft.

Jupiter, we now know, has a ring somewhat similar to Saturn's. Discovered by accident by Voyager 1, the ring is about 6,500 kilometres wide but only about one-half kilometre thick! Consisting of very tiny particles, it is not visible from Earth, but its discovery makes Jupiter the third planet in the solar system known to have a ring system. A ring system was found around Uranus in 1977.

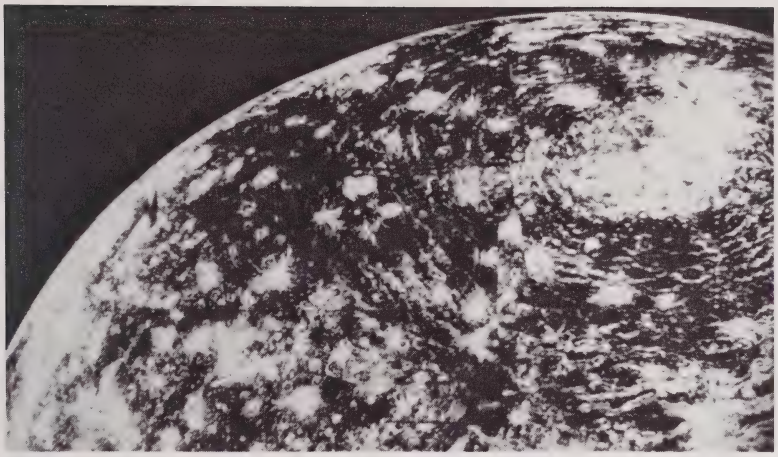
In addition to the flyby of Jupiter itself, both Voyagers made close approaches to five of Jupiter's moons, including the four Galilean moons. Described by one NASA scientist as the "oldest, youngest, darkest, lightest, most active, least active, and flattest" worlds in the solar system, the four largest moons of Jupiter are now sometimes regarded as "planets" in their own right because we know so much about them. For example, the moon Io has active volcanoes somewhat similar to those on our own planet, and one NASA scientist has recently suggested that the moon Europa might be a good place to look for life.



Above: Voyager 1 revealed a wealth of detail previously not seen by scientists. The white spots resemble the Great Red Spot, and the swirling streamerlike features are as yet not understood.

While the Voyagers were studying Jupiter, another spacecraft was rapidly approaching its destination. In late August and early September 1979, Pioneer 11 became the first spacecraft to study the planet Saturn. Launched from Earth six years previously and having survived a flyby of Jupiter in 1974, Pioneer 11 was given only a fifty-fifty chance of successfully passing within 21,000 kilometres of Saturn's cloudtops and completing its mission. Surprisingly, the spacecraft survived its encounter with Saturn and in the process made several important findings.

The first close-up pictures of the giant planet showed that Saturn's cloudtops, unlike Jupiter's, have little visible structure. In addition to the three known rings of material orbiting Saturn, two new rings were identified. The rings themselves consist of trillions of tiny bits of ice, all moving in vast orbits around the planet. Saturn was found to have a magnetic field and so joins Jupiter and Earth in the group of magnetic planets. A new moon, as yet unnamed, was discovered, giving



Opposite page, top: One of the best photographs of the planet Saturn, taken by Earth-based telescopes. The visible surface of Saturn has dark belts parallel to the planet's equator, but they are not as prominent as those on Jupiter.

Left: Photo-mosaic of Callisto from 202,000 kilometres away. The large feature with concentric rings is an impact basin about 600 kilometres in diameter.

Saturn a family of eleven moons. Though it had been thought possible that Titan, the largest of the eleven, might be found to support life, observations made during the exploration do not encourage this belief.

After a few days of intensive observation of Saturn, Pioneer 11 left the vicinity of the ringed planet and is now continuing a lonely journey into interstellar space. But long before the spacecraft leaves the solar system, contact with it will be lost because its radio signals will be too weak to cross the billions of kilometres separating it from Earth.

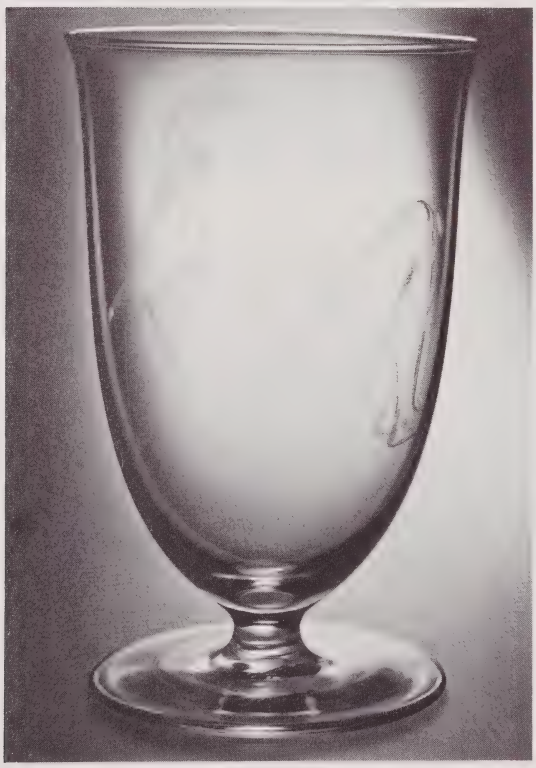
The Pioneer and Voyager spacecraft have begun the exploration of the distant outer worlds of the Sun's family. The Pioneer missions are completed, but the Voyagers have only started the first step of their journey which will span the 1980s. Voyager 1 is scheduled to reach Saturn in November 1980, and Voyager 2 in August 1981. With their powerful and sophisticated equipment, the Voyagers will study Saturn in much greater detail than was possible with the relatively primitive instruments of Pioneer 11. And if they are successful, Voyager 2 may be targeted for a rendezvous with the planet Uranus in 1986.

Thus the description of the past two decades as the "golden age of space exploration" is apt. It now seems possible that within twenty-five years of the first mission in 1961 seven planets will have been studied by robot probes and only tiny Pluto will await its first visit in the distant future. While the pace of planetary space exploration is now decreasing rapidly and only a few new spacecraft and missions are planned, the great beauty and the breathtaking vistas revealed by our first preliminary exploration of the planets have permanently changed our perspective of outer space.

Now another space age is dawning. The manned orbiting Space Shuttle, which is to be operational in the 1980s, will bring about the first large-scale utilization of space for human needs. We are launched upon an adventure that will change forever our understanding of our place in the universe.

Ian McGregor is a Producer at the McLaughlin Planetarium. He is a graduate of the University of Toronto and Queen's University and first joined the Planetarium staff in 1974. Mr. McGregor has been active in promoting public interest in astronomy for about nine years and as an amateur astronomer is currently President of the Toronto Centre Royal Astronomical Society of Canada. He travelled to Manitoba in 1979 to observe the total eclipse of the Sun and last February he was a leader of an expedition to Kenya to observe a solar eclipse.

The Growing Collections



Line engraving on glass, an art first practised in the 16th century, has been revived periodically. The engravers were often amateurs with varying degrees of talent who were not always involved in the production of the objects they decorated. In fact, linear engraving on glass, in contrast to cutting and intaglio engraving, is usually seen as a sideline. There have been few artisans who have succeeded in creating anything more than curiosities.

Engraving is found on Continental glass but it seems to be more of an ongoing tradition in British glass. The first identifiable English glass was made under the direction of the Italian workman Jacopo Verzellini in the late 16th century. His pieces invariably have coats of arms, mottoes, and other motifs engraved with a diamond and attributed to a Frenchman named Anthonye de Lysle. This technique, a favourite of glass engravers, is known as "diamond point". The next notable engraved British glass is a series of so-called "Amen" glasses engraved in the mid-18th century. These feature the lyrics of the Jacobite Anthem as sung by Stuart supporters and the word "Amen". The best-quality glass of its period, English glass was favoured by Continental engravers—notably those in Holland—during the late 18th century. The European Department owns a wineglass with a man's portrait stippled in diamond point, c. 1785, by the Dutch artist David Wolff. During the 19th century little glassware was decorated with exceptional linear engravings.

About 1935 the technique was revived by Laurence Whistler, a writer, and William J. Wilson, a prominent employee of the glass-making firm of James Powell & Sons. The two men developed a following in England and by the 1950s outstanding examples of engraving on glass were being executed. Since then engraved glass has been a much admired British art form, and for the Silver Jubilee in 1977 Sanderson Fabrics of London sponsored a special display of contemporary engraved glass. Although less well known than Whistler, the New Zealand-born John Hutton (1906–78) completed a number of large and important commissions. Many people have admired his great west screen in the rebuilt Coventry Cathedral. Canadians can see his engraved figures on the large screens in the National Library in Ottawa. Hutton used an engraving wheel to achieve sketchy, shaded lines which define the subject on the surface of the glass. Depending on the breadth and heaviness of these lines, the figures can be soft and delicate or powerful and intense—as in some of his biblical subjects. The example illustrated is a recent gift to the European Department and dates to the early 1970s when it was shown in an exhibition. For this lyrical subject, Hutton chose a simple vase of flowing form made by the Venini workshop of Murano, Italy. The Museum is very grateful to Mr. Rudi Eswarin of Toronto for his gift of this fine piece of modern glass. C.P.K.

The Far Eastern Department is very grateful to the Bishop White Committee for the gift of a Chinese painting. This hanging scroll, executed in ink on paper, is by Hua Yen (1682–1756), one of the outstanding creative masters active in Yang-chou, the most important art centre in 18th-century China.

Hua Yen was a prolific painter and has been credited as a versatile artist capable of painting a wide variety of subjects. His perceptive and humorous representation of animals in particular has won him high esteem among art critics. This painting of two squirrels, depicted playing about a large garden rock with tree branches, bears witness to his exceptional artistic skill.

The works by the Yang-chou masters have been hailed with revived enthusiasm in recent years as scholarly studies have reasserted their stylistic excellence and importance in the later history of Chinese painting. The innovative impetus that these painters provided was to influence artists till the present day.

It has been the hope of the Far Eastern Department to build up a comprehensive collection of works by the Yang-chou masters. Thus Hua Yen's painting fits in well with three other works by two of his contemporaries that are already in the ROM collection. Its addition brings us one step closer to the accomplishment of our objective.

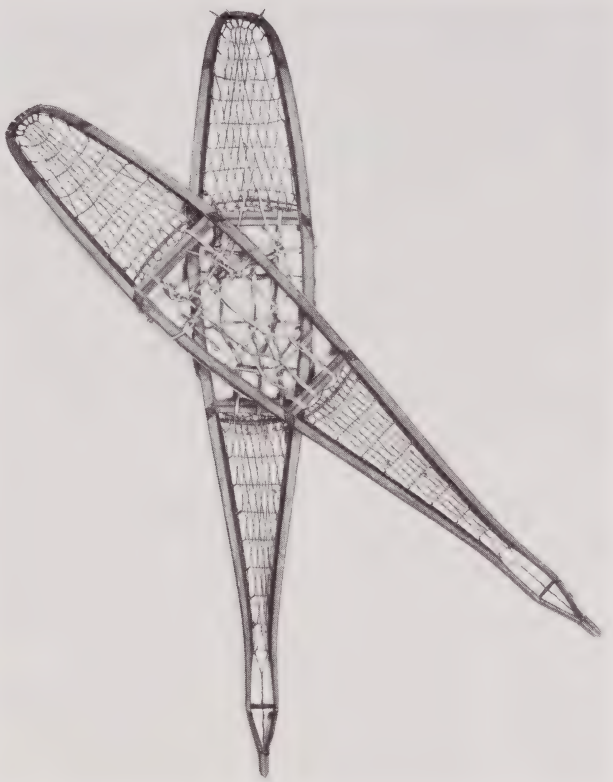
K.B.T.

The ancient coin collection of the Greek and Roman Department has been augmented by two gifts of Greek coins. Thirty silver coins collected by the late Mary E. White, Professor Emeritus of Classics at Trinity College, were donated by Dr. E. Perry White. Struck at various mints in Greece and Asia Minor, the coins date between the 6th and the 2nd century B.C. Seventeen are types or denominations not previously represented in the collection.

A silver tetradrachm of Syracuse, Sicily, was acquired through the generosity of Mr. R.E. Hindley. Struck about 480–470 B.C., the obverse (left) bears a victorious racing chariot with a winged Victory flying above; the reverse (right), the head of the nymph Arethusa surrounded by leaping dolphins. A.H.E.

"China-trade" portrait, oils on canvas, of the Nova Scotia barque *Emanuel Swedenburg*, painted about 1880. This vessel was built at Plympton, Nova Scotia, in 1878, and was wrecked off Brazil in 1891. Though the Canadiana Department in recent years has added substantially to its collection of Canadian ship portraits, this acquisition is the first example by a Chinese artist. D.B.W.

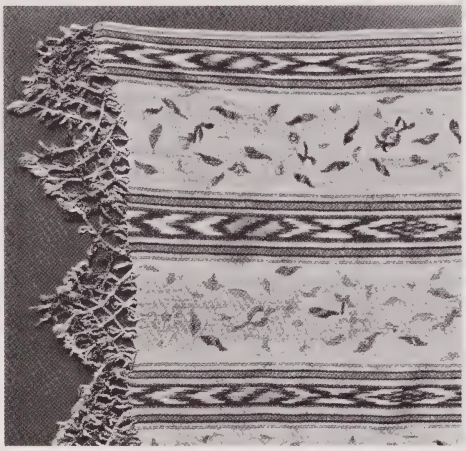
The Department of Ethnology recently had the good fortune of adding the pair of snowshoes illustrated here to its collections. This type of snowshoe, "Athapaskan, Round, Spliced Toe", is constructed from two pieces of wood joined to make a point at the heel and curved and spliced together to form a round toe. The interior of this type consists commonly of two or three crossbars with the toe and heel sections filled with hexagonal netting, and the foot section filled with hexagonal or rectangular netting. Snowshoes up to approximately 2 metres in length are employed for hunting where travel over the deep, powdered snow of the forest is necessary. Trail snowshoes, such as this pair, are usually about 115 centimetres in length and are used for travel over packed snow. Although identifying documentation is lacking for the illustrated snowshoes, their origin, as determined by the type's maximum distribution, is quite likely to be an area between the Mackenzie River and the western shores of Alaska.



Attribute analysis allows further breakdown within the type and can lead to the uncovering of regional variations. At this stage of the research the diagnostic elements are the third crossbar and the netting in the footspace. The rear, or third crossbar, is small (3.5 centimetres in length), which could imply a transition from the two crossbars common in the west to the three crossbars common in the east. Such a transitional element may indicate an eastern influence on the snowshoes constructed by more westerly cultures. The netting in the footspace consists of widely woven *babiche* with the thongs approximately 6 millimetres wide. These attributes are characteristic of the western section of the type's distribution. Towards the east the *babiche* is woven close together and has an approximate width of 1 to 3 millimetres.

Although it is not yet possible to designate a particular culture as being the snowshoes' originators, the attributes discussed suggest that their origin is probably in the western section of the type's distribution. The specific workmanship indicates that they were probably constructed by Athapaskan Indians rather than by the Inuit. Future research should include the identification of the wood species employed for the frame and the *babiche* type used for the netting. Analysis of the wood and *babiche* types may not pinpoint the exact culture responsible for the making of the snowshoes but it could lead to additional research involving the trade of raw materials.

K.R.L.



Two important donations have added significantly to the ROM collections of Spanish colonial textiles and costume from Mexico. The gift from Mr. and Mrs. W. Kent Newcomb includes 28 examples acquired by Mr. Newcomb's grandfather, Eman L. Beck, who lived in Mexico during the 1890s.

The prize of the collection is a pink and white striped silk shawl *(rebozo)* with embroidered figures decorating each white stripe (left). This is one of fewer than six surviving examples of the type. On the basis of the costume worn by the figures, the shawl can be dated quite precisely to the 1760–80 period.

Within weeks a second of these rare shawls (right) appeared in a collection of textiles donated by Mrs. Murray Vaughan. The Vaughan shawl features floral ornament and probably dates from the same period.

Silk shawls with elaborately knotted fringes were one of the most important costume accessories of *mestizo* women. In part derived from native regional garments, the *rebozo* became a highly artistic hybrid of fashionable European notions, native technology, and Asian export influences. J.E.V.

Quarrying has occurred for many years in the black *Posidonia* shale of Lower Jurassic age (180 million years old) in the area of Holzmaden, near Stuttgart, West Germany. This black shale, which accumulated as stagnant mud on an ancient sea floor, is famous for its beautifully preserved fossils. The Department of Invertebrate Palaeontology recently purchased a fine specimen of the sea lily *Pentacrinites* sp. from this locality. The stem of the animal is attached to a piece of carbonized wood. It is not certain whether the animal lived suspended from a floating log or was attached to a submerged log lying on the sea floor.

J.W.

The ROM has been fortunate in acquiring some fifty mineral species that were not previously represented in the collections. Most of these are new minerals described in recent years and currently available from various mineral dealers. Fourteen of these are extremely important as they are part of the TYPE material and become part of the standard reference material for those species; their scientific value is immeasurable. We are indebted to Dr. John L. Jambor of Ottawa for some of these TYPE specimens —six very rare sulphosalts from the Madoc area, Ontario. TYPE specimens representing two newly described Canadian minerals, sabinaite and gittinsite (both from Quebec), were presented by Mr. Gary Ansell, through the courtesy of the Geological Survey of Canada in Ottawa.

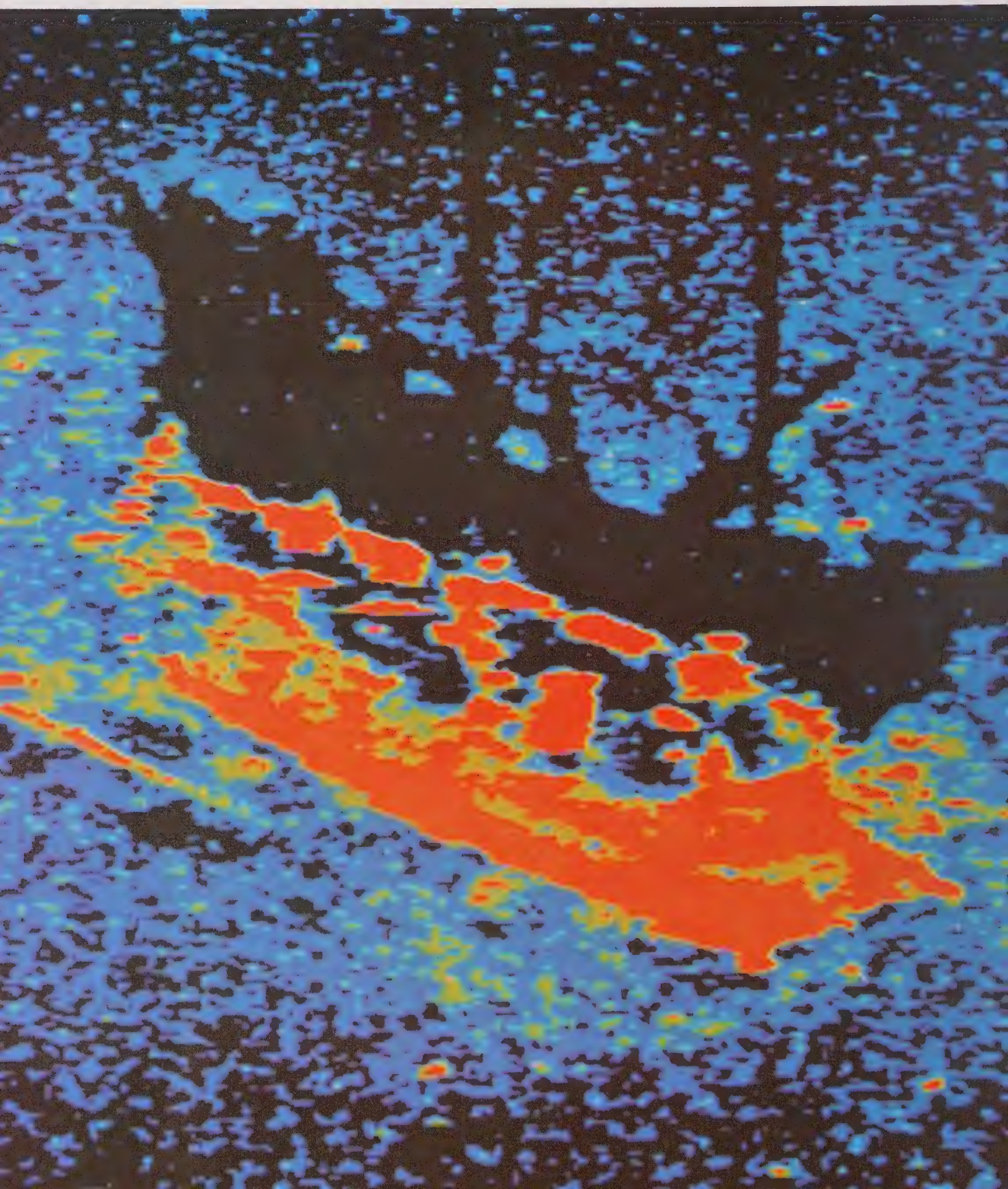
Our work continues in the study of the minerals from the Yukon Territory collected in the summers of 1978 and 1979 by departmental staff. As individual specimens and suites become properly described they are registered into the collections, some to form a basis of future displays and others to preserve material for future studies of this interesting area.

Although the bulk of the 500 specimens added between April and November 1979 were purchased, some were donated through the kindness of friends of the department, and others were obtained by exchanges with other institutions and individuals. R.I.G.

It is estimated that at present fewer than half the world's insect species have been discovered by science. There remains an enormous amount of pioneering work yet to be done in all aspects of entomology, and much of it will be done in Canada. We have reliable information on very few of the more than 66,000 Canadian insect (and related arthropod) species, for such basics as means of identification, geographic distribution, and life histories are still poorly known. To help remedy this situation, the Department of Entomology is a participant in the Biological Survey of the Insects of Canada, a national effort involving many scientists.

During the summer of 1979 a departmental field party led by Mr. Rein Jaagumagi spent ten weeks in the Yukon Territory and brought back 15,000 insect specimens for the permanent research collection. One of the most interesting yet least explored zoogeographic regions of the country, the Yukon is home to northwestern populations of *Limenitis arthemis*, the White Admiral, illustrated here. In this northern outpost of the species range, individuals are smaller than in southern Ontario and show more brick red colouring on the underside of the wings. The distinctive form without wide white bands *(L. a. astyanax)* does not occur in the Yukon. D.B.

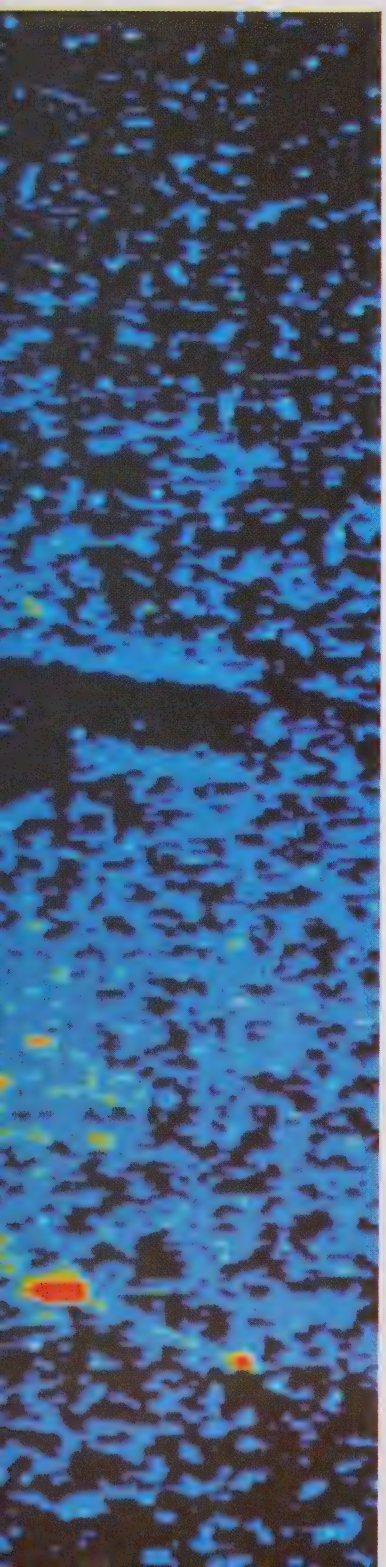
Gentlemen, Rascals, and



Winners

The Hamilton and Scourge Project on Lake Ontario

D.A. Nelson

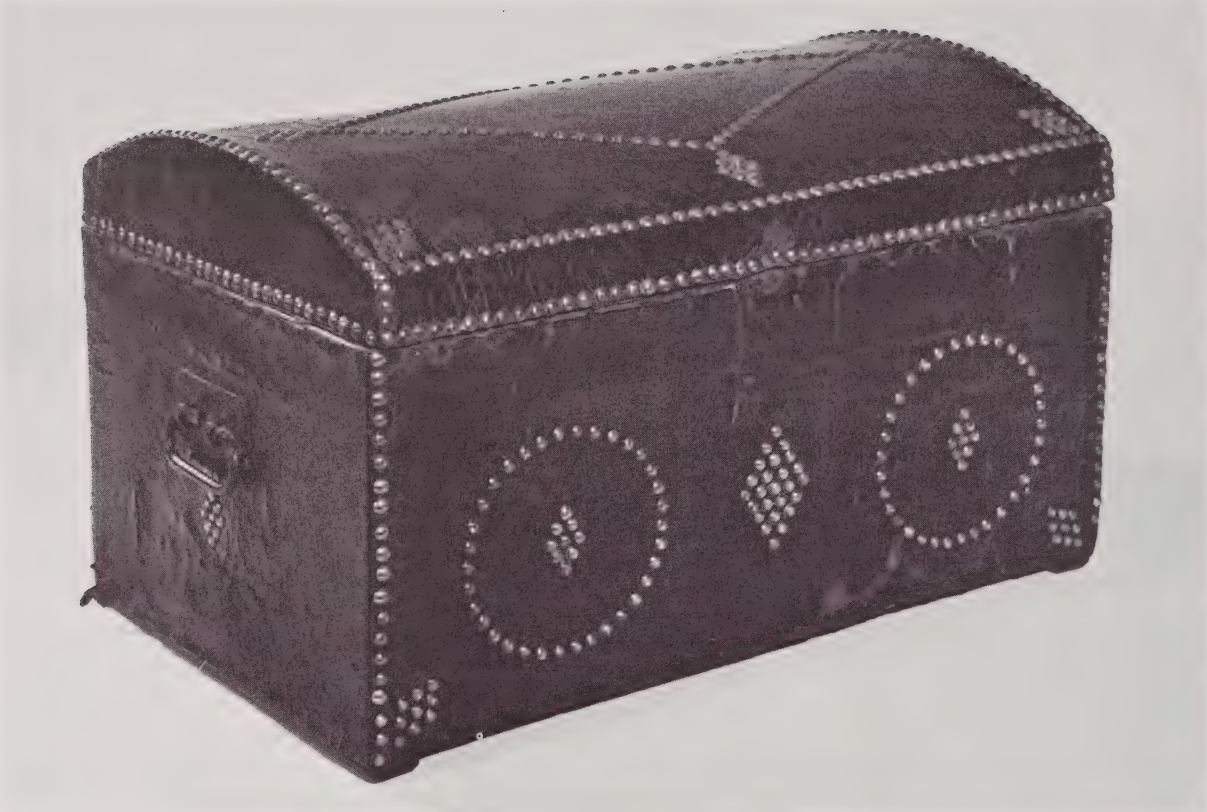


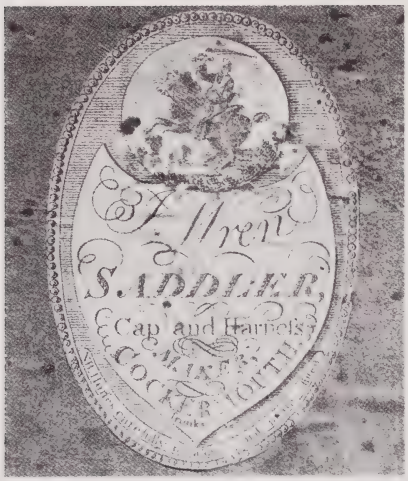
IN 1971 THE OFFICE OF THE CHIEF ARCHAEOLOGIST of the Royal Ontario Museum initiated a search for two War of 1812 armed schooners, the *Hamilton* and the *Scourge*, which were lost in Lake Ontario in the summer of 1813. Years of intensive historical research and underwater search involving sophisticated electronic methods followed before the ships were discovered in 1975, several miles off Port Dalhousie, Ontario, in about 300 feet of water. Since then sonar, television, and photographic probes have revealed that both ships are resting upright on the bottom, with guns on the decks, masts and bowsprits in place, and remnants of rigging still clinging to the spars. Although almost 167 years have passed since they were lost, these unique vessels, containing and surrounded by the possessions and bones of their dead crews, remain almost perfectly preserved in the eternal darkness and the 4° Celsius temperature of their freshwater grave.

Over the years the *Hamilton* and *Scourge* project has been supported by the Office of the Chief Archaeologist of the ROM, the Canada Centre for Inland Waters (Fisheries and Environment – Canada), the Ontario Ministry of Culture and Recreation, Parks Canada, and the Canadian Hydrographic Service. In 1979 title to both vessels and the responsibility for on-going programs involving detailed on-site surveys and feasibility studies, and we hope eventual recovery and conservation, were assumed by the City of Hamilton, Ontario.

Above: The Great Lakes top sail schooner Sauk, *formerly U.S.S.* Somers, *in the St. Clair River, 1815. Pictures of the* Hamilton *and* Scourge *are not known to exist. (Canadiana Department,* ROM*)*

Opposite: A computer-processed image, probably of the Hamilton, *derived from acoustic data obtained during the side-scanning sonar operations at the* Hamilton-Scourge *site on Lake Ontario. The varying intensities of the reflected acoustic signal are displayed in a four-colour format, with red representing the strongest reflections. The acoustic shadow of the ship is shown in black.*





Top: English leather-bound travel trunk brought to Upper Canada by early-19th-century settlers. (Black Creek Pioneer Village)

Bottom: Maker's label on the inside of the lid of the trunk. S. Wren was kin to Sir Christopher Wren. (Black Creek Pioneer Village)

While the scientific aspects of the project are challenging, one of the interesting rewards of the continuing historical research is the intimate knowledge acquired of both individuals and incidents. Although the people and events may have only a slight impact on the final course of history, the appearance and reappearance of even obscure names, in different references and contexts, is fascinating. Soon distinct personalities begin to emerge.

An intriguing example is found in the capture of the British schooner *Lord Nelson* on Lake Ontario and the fate of part of her cargo—seven trunks of personal effects being shipped from Montreal to Newark (Niagara-on-the-Lake). The *Lord Nelson* was seized, in supposed contravention of the Embargo Act, by the American brig of war *Oneida*, under the command of Lieutenant M.T. Woolsey, on 5 June 1812, two weeks before the War of 1812 was declared.

The *Lord Nelson* was a 110-ton merchant schooner built by John MacFarlane of Newark for William and James (later Sir James) Crooks in 1808. Many accounts describe the ship as one of the largest and best on Lake Ontario at that time. After her capture, the *Lord Nelson* was taken as a prize to Sackets Harbor, the American naval base at the eastern end of Lake Ontario.

At the beginning of hostilities in the summer of 1812, the British with four ships of war led by the 22-gun

ship-sloop *Royal George*, were comparatively better equipped on Lake Ontario than the Americans. The American force initially consisted of only the *Oneida*, which mounted sixteen 24-pound carronades. In order to bolster their single-ship force until new ships of war could be built, the Americans converted to gunboats the best merchant schooners available on Lake Ontario through purchase or prize. The *Lord Nelson* was one of these, and after being duly condemned and purchased into the United States Navy, she was refitted and emerged in the spring of 1813 as the schooner gunboat U.S.S. *Scourge*, mounting ten guns. Following custom, the general cargo of the *Lord Nelson* was condemned and bid off at a public auction, with the crew of the *Oneida* receiving one half of the proceeds. But what of the seven trunks of personal effects?

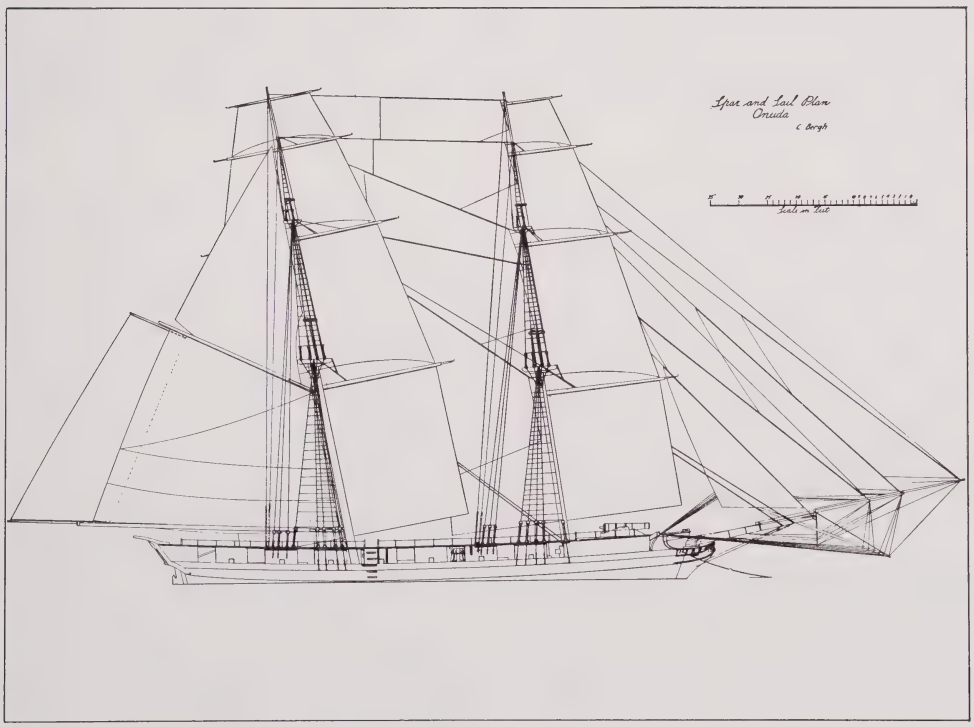
The trunks apparently contained the wardrobe of a certain Mrs. McCormick, described as a lady, a member of one of the first families of Upper Canada, and the wife of a merchant of respectability in Queenston, a village four miles up-river from Newark. The trunks had been sent to Mrs. McCormick by her father, a prominent gentleman of Montreal, and had been loaded aboard the *Lord Nelson* at Prescott.

Before the *Lord Nelson* was officially condemned, Lieutenant Woolsey ordered an inventory of the cargo. When the nature of the contents and the ownership of the trunks were discovered, he, being a man of honour, immediately wrote to one Lieutenant Colonel Fenwick, then on the Niagara frontier, requesting him to send, "by first flag which should cross the river, assurances that Mrs. McCormick's effects would be returned to her at the first opportunity".

Shortly afterwards Peter Curtianus, Esquire, Marshal of the State, arrived at Sackets Harbor from New York and informed Lieutenant Woolsey that both the ship and all her cargo, including Mrs. McCormick's trunks, had been condemned and must be auctioned off. After he had been made aware of the situation, Curtianus suggested that Lieutenant Woolsey might auction off Mrs. McCormick's trunks at a nominal price "merely for form's sake".

On the day of the sale the *Lord Nelson* was bid off to the Navy Department as required, and her cargo of general merchandise went to public auction. It was now time to deal with the trunks, and the purser of the *Oneida*, Alex Darragh, described the scene.

> We opened all the trunks and exposed their contents to the spectators. Capt. Woolsey then stated the wish of the officers and crew to return to Mrs. McCormick her effects, and that he should, for that purpose, bid five dollars and hoped no person would be so ungenerous as to bid against him. However, some persons then present, either from a wish to oppose the Navy, which had been instrumental in checking the violations of the laws of the United States, or to purchase silk gowns for their wives at a cheap rate, continued to bid. Capt. Woolsey, I believe with no other motive than to check them, bid the sum of five thousand dollars, and here the sale closed.



Spar and sail plan of the Oneida. *(From* The History of the American Sailing Navy *by Howard I. Chapelle. W.W. Norton & Company, Inc.)*

The trunks, however, were not disposed of as Woolsey expected. The Deputy Marshal, a Mr. Jason Fairbank, took them into his possession and ordered an appraisement and another public sale. At the same time he ordered that Lieutenant Woolsey should purchase the goods at about the appraised value and pay the deficit. The new sale was set for April 1813, a time when Woolsey was otherwise engaged at the capture of York (Toronto). The trunks were struck off to his representative, Amos Benedict, for $381.50.

It can be assumed that Mrs. McCormick finally received her seven trunks of clothing, and it is hoped that Lieutenant Woolsey eventually was reimbursed. His worries regarding his personal financial loss are evident in a letter to the Honourable William Jones, Secretary of the Navy, in May of 1813.

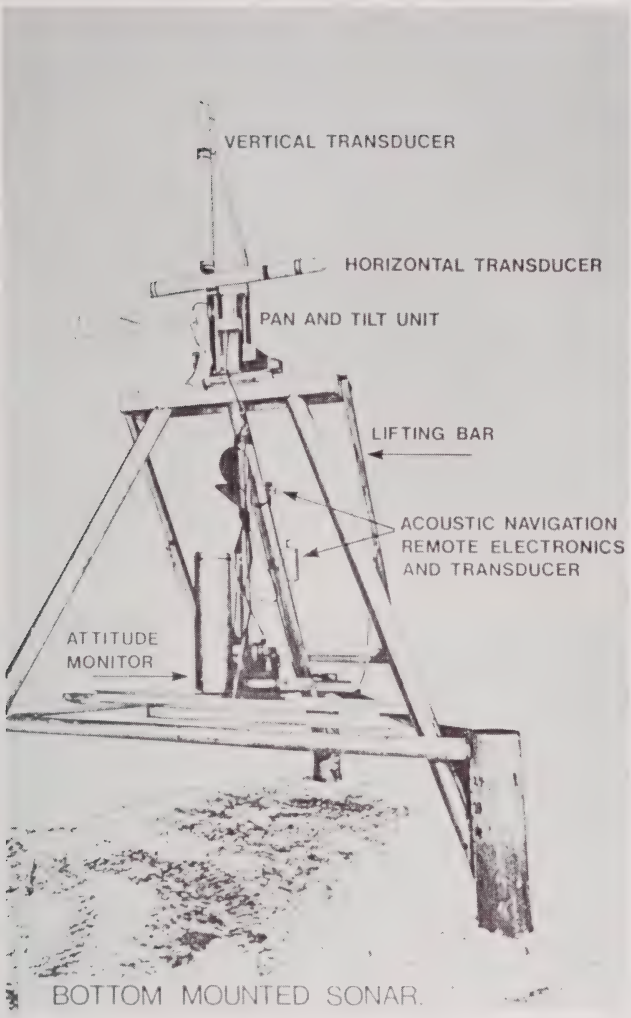
> I conceive that in consequence of the trunks not having been tendered to me when they were first purchased, and the subsequent steps taken by the Marshal, I am completely exonerated from the first bid—but I think in justice, I should be exonerated from the last also, as I never can, when the effects are returned to their proper owner, demand remuneration; particularly when my word, as the then commander of the station, was given to Mrs. McCormick that they should be returned.

Repercussions from the questionable capture of the *Lord Nelson* (the *Scourge)* recurred intermittently for many years, owing to circumstances no one could anticipate. The *Scourge* served with distinction with the American squadron on Lake Ontario during the spring and summer of 1813, participating in successful assaults on both York and Fort George. In the darkness of early morning of 8 August 1813, the *Scourge* and a sister ship, the *Hamilton,* were caught in a sudden squall on western Lake Ontario. They were set over and sank with all hands save sixteen.

Shortly after the cessation of hostilities early in 1815, the Crooks brothers, realizing that the *Lord Nelson* (the *Scourge)* could never be returned to them, petitioned the American government for restitution for the illegal capture of their ship. A tribunal was assembled to consider the matter and in due course decided that indeed the *Lord Nelson* had been seized illegally and set compensation at $5,000. In 1817 the amount was paid in cash to a court in upper New York State for disbursement to the Crooks brothers. However, before the transfer of funds could be accomplished, the clerk of the court embezzled the full amount and absconded with his stolen fortune.

The Crooks brothers again made application for the amount awarded, plus interest, and a new problem presented itself. What was the rate of interest to be? Sporadic discussions between the United States government and the Crooks brothers, and later their heirs, continued for almost a hundred years. In the meantime, the amount of the principal plus accumulated interest grew larger and larger. In 1914 a rate of simple interest of 4 per cent per year was finally agreed on. Not until 1928, 115 years after the loss of the *Lord Nelson,* did the surviving third and fourth generations of the Crooks family receive an unexpected bonanza of more than $23,000. If the interest had been compounded, the amount would have exceeded $450,000.

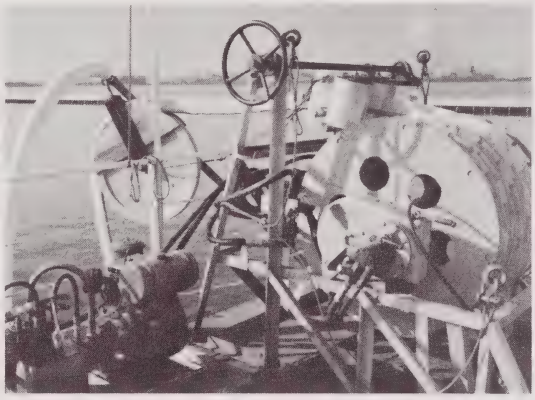
Continuing research into historical documents—both official and unofficial and usually consisting of single-copy reports, letters, and diaries—brought the pieces of this story together. In our day the telephone and other devices might be used in place of letters. Although the new methods are convenient, they produce no lasting record and little insight into the personality of the communicator, and perhaps our descendants will be somewhat poorer historically as a result of our technology.



Opposite page: Hamilton *and* Scourge *Project survey vessel* Lac Erie.

Left: Experimental bottom-mounted rig to produce acoustic images of deepwater structures used on the Hamilton-Scourge *site. (Courtesy Canada Centre for Inland Waters)*

Below: Shipborne winch and tow system loaded with faired cable used in the search phase.



Dan Nelson became a Research Associate in the Office of the Chief Archaeologist of the ROM *in 1968, with special interest in both underwater history and subsurface search technology. In 1969, 1970, and 1975 he led expeditions to the Anegada Reefs of the British Virgin Islands to search for and investigate historic shipwrecks. During this time he produced feature television films for the CBC and CTV networks. Since 1971 Dr. Nelson has directed the* Hamilton *and* Scourge *project on Lake Ontario. Dr. Nelson is a dentist, and maintains both his practice and his home in St. Catharines, Ontario.*

Tarantulas in the Museum

Eight-legged Gentleness

Brian D. Marshall

IT'S MONDAY MORNING AND AS I ENTER the Department of Entomology and proceed to the laboratory area where the "live stock" is housed, my attention is immediately attracted by the musical performance of the males of the European house cricket, *Acheta domesticus* (L.). Then, as I turn on the laboratory light, the music stops suddenly and the crickets scurry about frantically in their glass domicile. This morning they have good reason to be excited because today I will be feeding seven of them to the department's seven live tarantulas. Each tarantula is usually fed two crickets a week, and the feeding is a priority on Monday and Thursday mornings. To most people this diet seems unbelievably meagre. Inevitably their first remark is "Is that all?" or "I'd have thought that they would eat more than that."

Tarantulas are characteristically found in the tropical and subtropical regions of the world. While food is generally much more abundant in these regions than in our temperate region, there are a large number of organisms competing for it. In its natural habitat the tarantula requires more food during the very hot summer months when its metabolic rate is higher than during the cooler winter months when its metabolic rate is lower (in some regions it requires no food at all during the winter). In the laboratory, where the tarantulas eat all year round, two crickets per tarantula per week proves to be an adequate diet. The creatures are not fussy about what or how much they eat. They have a remarkable ability to adapt to a twice-weekly feeding schedule.

Our tarantulas are noticeably lethargic. Their behaviour is much the same as in their natural habitat where they stay in their burrows for much of the time, especially during the very hot hours of the day. They are nocturnal animals and generally feed during the cool hours, usually staying in or close to the protection of their burrows. Even in its own natural habitat the tarantula is not the life of the party. It does not perform many functions with any degree of rapidity, and seemingly walks, when it walks, with a great deal of caution, making sure of each step. It eats very slowly, constantly manipulating its food to get every last drop. This lethargic way of life is not very exciting for an observer, but it has its benefits for the tarantula. One of them is that since a very low amount of energy is expended, very little sustenance is required for survival.

In addition to their normal diet of house crickets, I have fed our tarantulas many different mouth-watering morsels, including such delicacies as mealworm larvae and adults, tent caterpillar larvae, and grasshoppers. Occasionally the tarantulas are treated to a large, juicy American cockroach that has been submitted to me by a disgruntled homeowner. If at any time live insects are not readily available (and this has yet to happen), I shall not despair, as I can always resort to tying a dead goldfish to a string and dragging it in front of the hungry beast. Tarantulas react readily to movement and would attack a dead goldfish being dragged in front of them.

Left: Dorsal view of a Mexican tarantula.

Below: Arthropod Gallery exhibit of live European house crickets.

In their natural habitat tarantulas generally construct burrows in which to live, but certain tropical species live in silk tunnels formed in trees. The tarantulas maintained in the Department of Entomology come from the southwestern United States and Mexico and characteristically construct a burrow. In our glass tarantulariums, we provide the basic requirements of the tarantula—cover (to simulate a burrow), food, and water. Our live tarantula exhibit in the Arthropod Gallery is a little more elaborate than our laboratory tarantulariums in that a mailing tube has been prepared to simulate a burrow and cactus plants have been added to enhance the desert appearance.

To many people a tarantula is simply a creepy, crawly, ugly, hairy creature, which they believe can liquidate a human life with its venomous bite. This belief is, of course, a fallacy, but it is common because of the imposing size of the animal (as compared with other spiders). The biologists' feelings about tarantulas are vastly different from those of the general public, since their point of view is more objective. Even though we do not carry out active research on these creatures at the Museum, we do observe their fascinating and timely behavioural activities.

Although our tarantulas are noticeably lethargic, a normal characteristic of tarantulas for much of their lives either in the laboratory or in the natural habitat, the word "lethargic" should not be misconstrued. It does not imply that each of the seven tarantulas stays huddled in a corner without moving a muscle. It simply

Opposite page: A Mexican tarantula.

Left: Ventral view of cephalothorax of the tarantula, showing cheliceral fangs.

Below: A tarantula in the process of moulting.

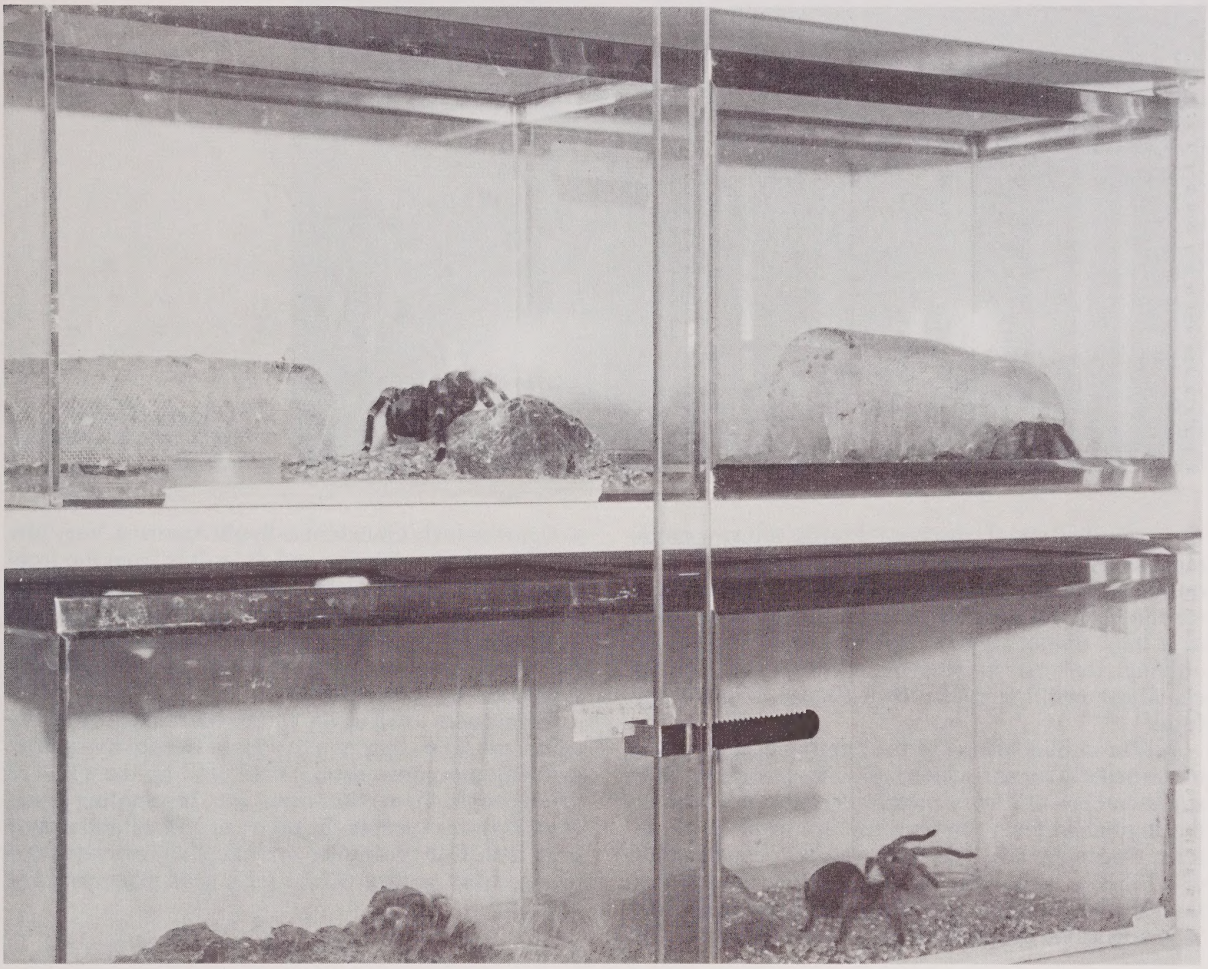
emphasizes the characteristic tarantula lifestyle, which is SLOW. Every movement or activity is a gradual process that is seemingly predetermined, except when the creature is after prey or when it has been frightened by a sudden current of air directed its way or by an attempt to pick it up.

I have observed a tarantula in the process of feeding for a period of approximately four hours. While this may seem incredible, there is good reason for the slowness of the process since the tarantula must liquefy its food before consuming it. The tarantula possesses piercing and sucking mouth-parts and so all sustenance ingested must be liquid. The feeding time varies according to the type of prey. An organism that is heavily sclerotized (hardened), such as a beetle, will take longer to liquefy (by means of enzymes secreted in the saliva) and consume than a less heavily armoured organism such as a grasshopper nymph. The leisurely feeding manner of the tarantula truly exemplifies the savouring of a meal. If I were to offer a second cricket to a tarantula that was already feeding on one, the tarantula would simply drop the first circket, entangle it in silk, and then drain the second of its life-sustaining fluids.

Throughout the year, but most often during the summer months, my attention is occasionally attracted to what appears to be a dead tarantula in the corner of its tarantularium. Close examination usually reveals a moulted exoskeleton (the outer protective covering or skin of most invertebrates). Once I observed a live tarantula on its back—a sure sign that the animal is in the initial stage of moulting. The main reason that the tarantula (like other spiders, crustaceans, and immature insects) moults is that the skeleton is external and therefore it has to be shed somehow in order to allow for growth. Another reason for the moulting is to

Opposite page: Tarantula with cheliceral fangs extended, showing droplets of venom.

Below: The tarantulariums in the laboratory of the Department of Entomology.



replace all body hairs and, gradually, any lost or broken appendages such as legs, palpi, and cheliceral fangs (fangs attached to the chelicerae, which are appendages at the anterior portion of the cephalothorax, the combined head and thorax). The moulting process lasts approximately three hours. After "shedding its skin" the tarantula is very teneral (soft) and vulnerable. A hardening process lasting about two hours allows for the new exoskeleton to strengthen and the heavily sclerotized parts, such as the cheliceral fangs, to darken and harden.

One interesting feature of our tarantulas is the silk formations they lay all over the tarantulariums. Tarantulas, which belong to a primitive spider group, do have functional silk glands and can lay silk, but they do not form a silk web for the purpose of catching their prey as the true (higher) spiders do. Tarantulas are "wandering" predators and capture their prey by pouncing on it; they therefore do not require a web. The formation of silk on the glass cannot be observed throughout the year, probably because it is not natural for tarantulas to lay large quantities of silk continuously. The times of the year when the silk formation is most noticeable probably correspond to the periods when the natural reproductive stimuli of the animals are active.

Few people are aware that the tarantula possesses defence mechanisms other than its cheliceral fangs. This is because a tarantula is basically docile and generally has to be provoked to bite larger animals, like man. It normally does not use its fangs freely for defensive purposes. More commonly, the tarantula will use its hind legs to flick the hairs from the upper posterior surface of its abdomen into the face of an oncoming predator. These hairs are described as urticating since they have a powerful irritant action when

Arthropod Gallery exhibit of a live Mexican tarantula.

they come in contact with bare skin (the stinging nettle plant produces a similar reaction). However, there is no lasting skin discomfort. The bite of most subtropical tarantulas is no more dangerous to man than the sting of a bee. Some tropical species are larger, and although their bite is somewhat more painful, and the resultant swelling lasts a little longer, it is still not fatal.

All tarantulas belong to the family Theraphosidae of the order Araneae which includes all spiders. They are members of a very primitive group that can be distinguished from the true spiders by several criteria: imposing size, abundance of hair, construction of a burrow rather than a web, and vertical rather than horizontal movement of the cheliceral fangs. The Theraphosidae are distributed all over the world and are particularly abundant in South America. Very few species occur in Europe and Asia. It is from the tropical areas of their distribution that the misleading common name "bird-eating spiders" comes. There are approximately 600 species of tarantulas throughout the world, with about 30 of these occurring in the southwestern United States.

Tarantulas are known as the Methuselahs of the spider world as they can live up to twenty-five years. Unfortunately they send a cold chill up the spine of many people. To me they are a very fascinating group of animals that people should try to understand rather than fear. Our tarantulas are excellent conversation pieces today as they will be for a good many years to come.

Brian D. Marshall is a Technician III in the Department of Entomology. He graduated from Sir Sandford Fleming College with a Forest Technician Diploma in 1975 and with a Fish and Wildlife Technician Diploma in 1976. His first exposure to tarantulas came when he joined the Museum staff in 1976 and his duties include maintaining a variety of living arthropods. He is at present enrolled in part-time studies at the University of Toronto.

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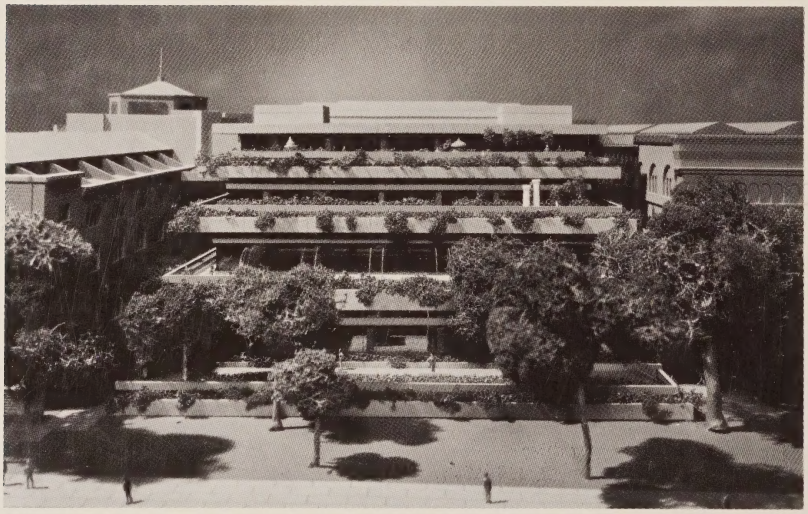

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